



Trenton Area Storm Water Management Project

JACKSON DITCH WATERSHED

Fall/Winter 2006

Project Description

The Butler County Storm Water District (BCSWD) was formed in 2002 as a cooperative effort among public entities in Butler County to address regulations promulgated by the Environmental Protection Agency (EPA). One of the primary goals of the BCSWD is to "improve the quality of our environment by reducing pollution to Butler County's rivers, streams, and lakes".

As a part of that mission and in response to urban development pressure, increasing flood potential, and a desire to protect the underlying Great Miami River Buried Valley Aquifer from potential pollution associated with storm water runoff, the BCSWD, as a function of the Butler County Engineer's Office (BCEO), commissioned a watershed study and storm water management plan for the Jackson Ditch watershed located on the west side of the City of Trenton.

Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) was selected to complete the effort in February 2005 and assembled a team with expertise in the fields of

hydrology, hydraulics, stream restoration, water quality, and hydrogeology to assess the watershed and create a storm water management plan. The result of the effort was a set of recommendations for storm water control and a collection of tools that includes surface water runoff models, a planning and protection map, and an example development concept plan. These tools and recommendations collectively form a storm water management plan (SWMP) that BCSWD and local stakeholders can use for ongoing storm water management in the watershed for years to come.

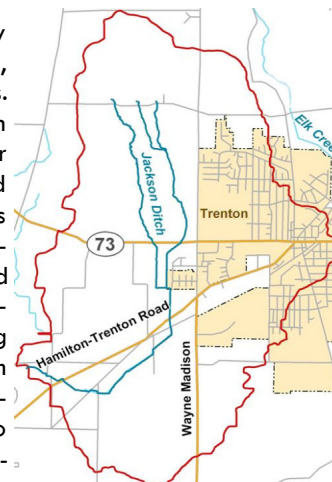
This publication describes the key issues, findings, and recommendations from the development of the storm water management plan for the Jackson Ditch watershed.

Storm water planning and protection on a watershed scale is a relatively new approach for the Butler County Storm Water District. The Jackson Ditch watershed was an excellent first application of the process and we look forward to others as we continue to protect and enhance Butler County's water resources.

Jackson Ditch: A Valuable Butler County Resource

Jackson Ditch is a largely manmade channel originally constructed for drainage of farm lands in the area, today it collects excess storm water runoff from areas west of the City of Trenton and carries it downstream to a few sink areas near Busenbark and Gephart Roads, where it ponds and soaks into the ground. The watershed is rapidly developing and with growth comes increased storm water volume and threats to water quality. A big part of the area's economy is

predicated on the availability of clean water for residential, agricultural, and industrial uses. Most of that water is withdrawn from the underlying Lower Great Miami River Buried Valley Aquifer which is recharged largely through infiltration from Jackson Ditch and the surrounding area. Protecting the aquifer from the long term potential of pollutants from storm water is vital to maintaining the aquifer's ability to supply clean water to its stakeholders. Controlling storm water pollution starts at the source.



Overview of the Jackson Ditch Watershed.

INSIDE THIS ISSUE

Project Description	1
Jackson Ditch: Valuable Butler Co. Resource	1
Watershed Summary	1
Watershed Character and Issues	2
Modeling as a Decision Support System	2
Structural Solutions: A Costly Quick Fix	2
Long Term BMPs are Key	3
BMPs and Their Land Use Connection	3
Storm Water in Butler Co.: The Big Picture	4
Jackson Ditch: Implementation	4

Watershed Summary

The Jackson Ditch Watershed...

... is situated in Wayne, Madison, and St. Clair Townships and includes the western portion of the City of Trenton.

... encompasses an area of approximately 10.2 square miles; is home to an estimated population of 7,600; and collects runoff from approximately 3,500 parcels of land.

... is located in a unique hydrogeologic setting over the Lower Miami River Buried Valley Aquifer.

... is characterized largely by residential, agricultural, and industrial land uses. Most of these land uses withdraw water from the aquifer for process and drinking water use.

... is drained by a network of natural and manmade channels, with roughly 40% of the watershed draining to sinks that infiltrate directly into groundwater.

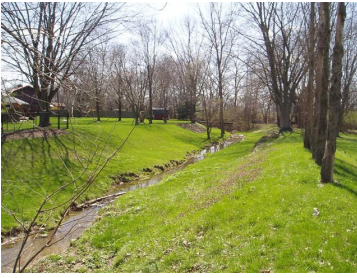
... overflows into Jackson Ditch, which is a largely manmade channel approximately 9.5 miles in length that captures approximately 6.1 square miles of the watershed area.

... Jackson Ditch has no natural outlet. Excess runoff from normal storm events drain to low-lying infiltration areas near Riverside and Gephart or Hamilton-Trenton and Busenbark Roads.

... is growing rapidly and experiencing storm water development pressures that if left unchecked will cause flooding and degrade surface water quality.

Jackson Ditch Watershed

Watershed Character and Issues



Typical stream conditions in the man-made mainstem portion of Jackson Ditch.



Significant debris accumulates along portions of Jackson Ditch hindering efficient drainage as seen here on the Miller Brewing Company property east of Riverside Drive.



Wet detention/retention basins like the one shown here are good for controlling storm water runoff, but are costly to construct and maintain and require frequent cleaning.



Mechanical pre-treatment devices work well for water quality control but can be costly to install and maintain. These have applications for certain commercial and industrial land uses, but are impractical for most residential uses.

Today, the Jackson Ditch Watershed is in relatively good condition for an urbanizing stream system. Water quality appears to be good from a source perspective, but surface water quality issues could very easily occur in the future that would change those conditions. Of particular threat are the quality of aquatic life and ecological habitat in the stream, as these are typically the first areas affected in pollution impaired streams.

The long-term importance of the aquifer as a drinking water source makes elimination of groundwater pollution sources critically important. Potential

pollutants including metals, excess nutrients, and imbalanced nitrogen/phosphorus levels come from a variety of sources, but chiefly are a side effect of land use and development practices. Dry wells are used extensively in the watershed and work well for drainage, but are poor for prevention of groundwater pollution.

Hydraulically, the performance of the stream system is marginal, with a few undersized culverts and significant clogging due to debris causing minor flooding and ongoing maintenance burdens, but ultimately it has no outlet for

the water to drain to. Long term planning is critical to prevent further flooding issues that could affect life or property.



Undersized railroad culvert



Typical dry well installation

Modeling as a Decision Support System

The data presented here is based on research; interviews with residents and stakeholders in the watershed; field reconnaissance; knowledge of other developing watersheds; and computer models of the watershed created by FSM and XCG Consultants, Inc.

FSM developed a hydrologic model using HEC-HMS to analyze the rainfall-runoff characteristics of the water-

shed, and a hydraulic model using HEC-RAS to simulate stream performance and predict flooding depths and extents. XCG developed an HSPF model for the watershed to simulate water quality performance of the watershed.

The purpose of the modeling effort was to simulate key storm water processes in the watershed to gain a better understanding of the various

interactions between rainfall, runoff, and land use in the watershed. The models include assumptions for both existing and potential future land use conditions to allow for what-if analyses of potential development scenarios and evaluation of mitigation options to solve recognized storm water issues. The models will be a tool used to assist with ongoing storm water management in the Jackson Ditch Watershed.

Structural Solutions: A Costly Quick Fix

The classic approach to storm water issues is to simply build facilities to accommodate the problems. The models allowed for several of these structural solutions to be analyzed including: water quality retrofits; improvements and modifications to culverts; installation of auxiliary overflow channels; stream modifications and restoration; and regional detention/retention basins.

These options have potential applications in the watershed and can provide favorable benefits, but based on economic evaluation, the costs seem prohibitively high. For example, to alleviate the flooding that occurs near Riverside Drive a voluntary buy-out of 21 homes is estimated to cost on the order of \$3.2M, but a regional basin would cost approximately

\$5.6M. Finding a funding mechanism for either option that is fair to the community is a challenge. Since the watershed does not have an outlet, many of these solutions can cause more problems than they solve as they move storm water downstream causing further flooding. Lastly, more surface water leaving the watershed, means less water available to recharge the aquifer.

Best Management Practices (BMPs)

Long Term BMPs are Key

As an alternative to structural solutions, BMPs and planning activities in the watershed can also provide storm water benefits, particularly from a water quality perspective. The underlying theme for protecting the watershed is to prevent pollution at its source. This distributed approach is practical, cost effective, and easy to implement as it is typically done by private stakeholders as opposed to

local municipalities. The downside is the BMP approach can take several years before tangible results are realized. The Jackson Ditch SWMP includes a number of activities and practices selected to be beneficial for this watershed such as: grassy swales, infiltration trenches, infiltration basins, and bioretention areas. In general, the goals of these BMPs are to:

minimize impervious area; maximize vegetation and green space; encourage on-site infiltration; promote drainage over and through vegetation; promote good storm water housekeeping and development practices; increase the focus on wellhead protection zones; continue effective planning; and encourage the community and stakeholders to participate through education and outreach initiatives.



Top to Bottom: Grassed swales and infiltration trenches are an excellent way to control water quality and encourage infiltration to reduce channel flooding. Straw and netting protect channels from erosion during construction until vegetation is established.

BMPs and Their Land Use Connection

Given the costs involved in structural mitigation options and the nature of problems identified, the Jackson Ditch Watershed is well suited for a BMP solution approach. The key to using BMPs is in their application.

For the Jackson Ditch Watershed, this is predicated on the assumption that land use is the key variable. Each land use has its own issues and corresponding set of BMPs that help address those issues. Several examples are illustrated at right.

There are numerous sources for BMP documentation and information. The Ohio Dept. of Natural Resources Rainwater Manual now in draft format is an excellent reference and has many topics applicable to Butler County and the Jackson Ditch watershed.

For storm water management purposes, the land uses in the watershed were classified into 5 groups, each having its own particular concerns, then BMPs were recommended which should be considered as the minimum acceptable control measures to help address those concerns.

Industrial and Heavy Commercial Land Use

Concerns: Impervious area; oil & grease; metals; nondegradable pollutants

BMPs: reduction of directly connected impervious areas; mechanical pretreatment devices for high risk facilities; prohibition of dry wells for these land uses; detention/retention or bioretention basins for sites > 5 acres, onsite volume/peak controls for others; industry outreach

Urbanized Residential and Light Commercial Land Use

Concerns: Lawn & garden chemicals; increased runoff; metals and chemicals from automobiles

BMPs: development manual to establish common guidelines; green space planning; stream buffers and vegetative setbacks; grassed swales; low impact development techniques; good housekeeping; enhance household waste program; adopt-a-watershed

Construction Sites

Concerns: Erosion control; solid waste pollution; vehicle washing; and illicit discharges

BMPs: ODN Rainwater Manual and/or development manual; contractor pollution prevention plans; increase enforcement authority; sediment and erosion controls such as: silt fences, check dams, mulching, erosion control mats, seeding, etc.; contractor education and outreach

Rural Residential and Agriculture

Concerns: Nutrient loading; pathogens and animal wastes; failing/inadequate onsite septic systems; local wellhead protection

BMPs: Optimal use of fertilizers, pesticides, and herbicides; control of animal operations; encourage green space and vegetative stream buffers through storm water credits; sanitary sewer system planning; education and outreach

Undeveloped Land

Concerns: Loss of green space; others described above

BMPs: Planning and outreach; development controls for land use transitions



Source: Ohio Watershed Network

Rain gardens and other low impact development techniques are good for residential areas, but not as effective for industrial areas.



Source: ODN Rainwater Manual (Draft)

Construction sites are notorious for erosion and sediment. Control of off-site drainage through BMPs such as silt fences, check dams, and construction entrances is critical.



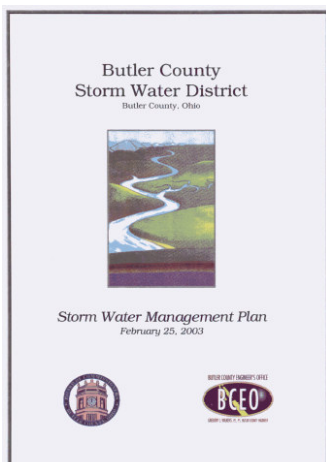
Agricultural Drainage

Water Quality Impacts and Subsurface Drainage Studies in the Midwest
Bulletin 871-98

Agricultural areas also benefit from BMPs in terms of increased productivity as well as watershed protection.

Storm Water Management Plans: Butler County & Jackson Ditch

Storm Water in Butler County: The Big Picture



When the Butler County Storm Water District was established one of the first tasks was to prepare a district-wide storm water management plan to help address EPA regulations. The BCSWMP was organized according to EPA's 6 minimum control measures:

1. Education and outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination

4. Construction Sites
5. Post Construction Storm Water Management
6. Pollution Prevention & Good Housekeeping

For the control of storm water in the Jackson Ditch watershed and other watersheds in Butler County, the plan still applies, but many features are scaled down to the watershed level and efforts are targeted to the specific threats and stressors to the watershed in the same

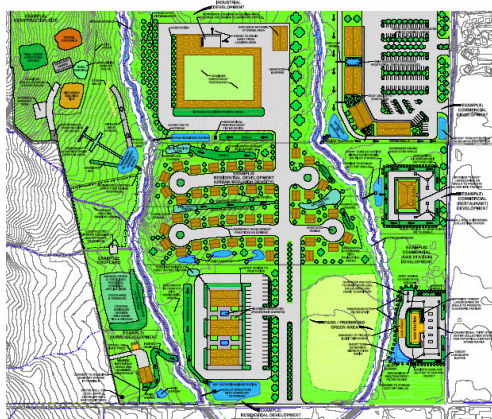
manner that BMPs are targeted towards particular land uses. Many activities that the Butler County Engineer's Office is involved with on a daily basis fit this plan. Control of development practices, planning, education and outreach, and wellhead protection are particularly important to the Jackson Ditch watershed, and can be controlled by Township and County Zoning, but active participation of local stakeholders is also important.

Jackson Ditch: Implementation

The storm water management plan for the Jackson Ditch watershed is not a single document, but a collection of several reports, presentations, and exhibits created by FMSM and BCSWD during the course of this project. These materials highlight identified and potential issues in the watershed and discuss industry trends

in storm water management that work well for controlling the impacts of those issues, they also provide recommendations for practices and activities to improve the watershed. Certain features of the plan, such as development controls, can be adopted by ordinance or supported by BCSWD, but the community must take the lead for other activities.

Implementation of a storm water management plan requires cooperation and participation from many varied interests, including: Butler County, local governments, private developers, individual property owners, local industries, and concerned citizens. Establishing an education and outreach program is the best way to coordinate these stakeholder groups and vital to the success of the storm water management plan.



One tool developed for the Jackson Ditch SWMP is an example development scenario that illustrates a variety of land uses and typical BMP applications for each land use.

RECOMMENDED ACTIVITIES

Flooding

- Work with the railroad to better maintain culverts
- Establish a storm water credit program for stream debris clean-up through cooperation with the local school system
- Maintain the sink on Miller Brewing's property as a storm water detention and infiltration area
- Consider purchasing the site at SR 73 for future use as a regional storm water detention/retention facility
- Replace poorly installed culverts along Jackson Ditch
- Limit development in recognized floodplains through ordinance

Sensitive Areas

- Preserve recharge areas near and downstream of Gephart Rd.
- Strictly enforce erosion & sediment controls for development
- Require stringent storm water controls for new industry
- Update the area's land use plan to consider storm water
- Revise local/county zoning regulations as needed

Water Quality

- Cooperate with the Soil and Water Conservation District to assist farmers with storm water runoff controls
- Evaluate mechanical pre-treatment and filtration devices by retrofitting and monitoring a local gas station outfall
- Require mechanical filtration on new potential problem sites
- Establish guidelines for the use of BMPs throughout BCSWD

Infiltration / Recharge

- Mitigate declining groundwater levels thru direct stream recharge and preservation of recharge areas
- Support use of BMPs through credits and assistance with grants
- Retain riparian buffers



Prepared by:
Fuller, Mossbarger, Scott
& May Engineers, Inc.

11687 Lebanon Road
Cincinnati, OH 45241
Phone: (513) 842 - 8200
Fax: (513) 842 - 8250

JIM ROZELLE, PE, PS
FMSM ENGINEERS
WATER RESOURCES PROGRAM MANAGER, OHIO

Visit us on the web!
www.stormwaterdistrict.org
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Note: All maps shown herein are provided as examples, full size versions can be obtained on a limited availability by request from BCEO.